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ABSTRACT

The postsecondary educational plans of black and white high school seniors in the class of 1972 were compared with those in the same racial classification in the class of 1980. Four planning categories were examined: vocational school, community college-vocational, community college-academic, and 4-year college or university. Data were extracted from the National Longitudinal Study of the High School Class of 1972 (NLS) and the High School and Beyond (HSB) survey. Three aptitude variables were examined: lower quartile, middle two quartiles, and upper quartile. The long-linear model, which was used for the analysis, is described. The regression analog suggested by Knoke and Burke was used to identify the model of best fit for each of the study groups. It was found that larger percentages of more-able students planned to attend 4-year institutions than is the case with the less-able students. A greater percentage of students were choosing 4-year schools in 1980 than in 1972, and the percentage of blacks in the top quartile of the aptitude distribution increased from 4.9 to 8.6 percent. It is concluded that relative to the study groups, blacks seem to have increased in academic aptitude over the 1972-1980 period. However, differences in nonresponse rates for the two surveys (NLS and HSB) and the evidence from aptitude scores from the Scholastic Aptitude Test and the American College Testing program may raise doubt about the occurrence of an absolute increase in the aptitude of blacks. It was also found that over 75 percent of blacks and over 68 percent of whites in the low-aptitude quartile are planning to attend colleges and universities. (SW)

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FACTORS RELATED TO THE PERFORMANCE OF TWO-YEAR COLLEGE TRANSFER STUDENTS

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This paper was presented at the Twenty-Second Annual Forum of the Association for Institutional Research held at the Denver Hilton Hotel in Denver, Colorado, May 16-19, 1982. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum papers.

D. R. Coleman, Chairman
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Introduction

Two trends in the traditional college-age population seem likely to influence the quantity and quality of the postsecondary student population over the next several years. The first of these is the yearly decrease in the average scores of the college aptitude tests; although there is some evidence that this decline may have halted (Biemiller 1981). The second is the decreasing number in the college-age cohort, the 18-24 year olds (Crossland 1980; Glenny 1979). This latter trend is predicted to reduce the total number of postsecondary students as much as 15 percent over the coming decade. When considered jointly, these two trends indicate there will be a smaller pool of traditional college-age students, and the quality of students in the pool may not be as high as it has been in the past.

Several strategies have been proposed to offset the predicted enrollment decline over the next ten years. Among these are proposals to increase the enrollment of young students from lower- and middle-income families, to increase the college-attendance rate of the 18-24 age group, and to increase the enrollment of minority youth (Frances 1980, pp. 42-43). While these proposals are not necessarily mutually exclusive, they imply dipping deeper into the college-age cohort in coming years in order to maintain enrollments at present levels. While it may be possible to increase the college-going rates of the more able students in these cohorts, it seems unlikely that the number of these students can be increased enough to offset the expected decline. If this proves to be the case, then the college-going rates of the less-able students will have to be increased to offset the expected decline. The research in this paper will examine the implications of this latter eventuality by examining postsecondary educational plans of high-school seniors from the class of 1972 with those of the class of 1980. Shifts in college plans are an indicator of the likely success of implementing the proposals mentioned above.

The purpose of the research reported here is to compare the postsecondary educational plans of black and white high-school seniors in the class of 1972 with those in the same racial classification in the class of 1980. Four planning categories were examined: 1) vocational school, 2) community college-vocational, 3) community college-academic, and 4) four-year college or university. Of special interest were 1972-1980 changes among planning categories within three levels of aptitude for each of the racial groups.

Review of the Literature

While there is an extensive body of research literature dealing with the postsecondary educational plans of high-school students, definitional problems and the local or regional nature of the populations sampled make comparison of many of these studies tenuous at best. Two comprehensive bibliographies were found in the literature review for this paper, one by Kuvlesky and Reynolds (1970) and one by Marini (1978). The Kuvlesky and Reynolds piece is a compilation of studies concerning educational expectations and aspirations of youth conducted prior to 1970; there is no discussion or annotation of the studies listed. Marini, on the other hand, does compare and discuss many of the studies found in her article. Her article, however, deals mainly with studies concerned with sex differences in educational expectations and aspirations. Discussions of the definitional problems inherent in the interchangeable use of the terms plan, expectation, and aspirations are given by Rodman and others (1978) and Freeburg and Rock (1975).

Several studies have examined the postsecondary plans of high-school students longitudinally in order to identify trends among various subpopulations, usually blacks and whites by sex. Drabick (1973) studied the educational expectations of high-school seniors in North Carolina using similar

samples taken in the years 1963 and 1970. Notably fewer blacks than whites in the 1970 sample had high postsecondary educational expectations. These findings were contrary to those from the 1963 sample, although, largely attributable to lower expectations of black females as proportions of black males with high expectations remained virtually the same in 1970 as they were in 1963. Boyd (1974) studied tenth graders in South Carolina in 1966 and 1972. His study showed an increase in the number of black and white males aspiring to attend vocational schools. In a study similar to Boyd's, Stuart and Dunkleburger (1974) examined high-school seniors in northern Appalachian Alabama in 1966 and 1972. It showed little difference between whites and blacks in terms of educational goals in either year with a rather consistent trend toward lowering of goals over the period. A national longitudinal study based on ACT data from college-bound students was published by Maxey and others in 1976. Data for this study covered the academic years 1970-71 through 1974-75. Very little change in the degree aspirations of students was noted over the period studied.

Stafford (1976) in a study of Florida high-school seniors found that the public community college was the most frequent aspiration of this group. A national study by Fetters and others (1977) did not confirm the Stafford findings regarding type of college planned. Using data from the National Longitudinal Study of the High School Class of 1972 (NLS), they found that four-year colleges and universities was the most popular institutional choice, followed by two-year colleges and finally by vocational/technical schools. Several other researchers have also used the NLS as a data base to study various aspects of postsecondary plans (Freeburg and Rock 1975; Dunteman and Bailey 1975; Clowes and Levin 1980; and Dawkins 1980).

Data Sources and Methodology

Data for the study reported here were extracted from the National Longitudinal Study of the High School Class of 1972 and High School and Beyond (HSB). Each of these national surveys contains a probability sample of high-school seniors. The NLS had more than 16,000 respondents to its Base Year Survey (Riccobono and others 1981) while HSB had more than 28,000 respondents in the base year (HSB 1980). Both surveys have oversampled minority and disadvantaged students but contain weighting variables for each respondent which can be used to adjust for the oversampling.

While not all questions are the same in each of these surveys, the question regarding students' plans for the year following high-school graduation is replicated in both surveys. In addition, a series of tests were given to each of the base-year respondents in each survey which allow construction of a trichotomous aptitude index.

Each of these surveys has an aptitude index as one of the variables available for each student in the survey completing the aptitude battery administered in the base-year survey. However, only some of the tests in each battery were the same in both of the surveys. Following a suggestion by Peng (1981), a comparable aptitude measure derived from a subset of the tests in each battery has been developed (Brown and Luiten). This measure was used in these analyses.

In order to test for differences in postsecondary educational plans between the two surveys, students in each survey were cross-classified by type of school/program planned and aptitude. There are four categories of the school/program variable: 1) vocational school, 2) community college-vocational, 3) community college-academic, and 4) four-year college or university. The aptitude variable has three categories: 1) lower quartile, 2)

middle two quartiles, and 3) upper quartile. Using the two surveys as a third classification variable results in a three-way classification scheme of school/program planned by aptitude by survey. A log-linear model was chosen as the statistical technique since it provides a test for association of nominal level variables when the "same set of items are measured by surveys conducted at two points in time" (Knoke and Burke 1980, p. 47). The log-linear model allows for the introduction of time (in this case the base year of the two surveys) into the model and a test for association of time with one or more of the substantive variables in the model.

The Log-Linear Model

It is not possible in a short paper such as this to give a detailed explanation of log-linear models. Those interested in a more complete treatment of this technique should read the monographs by Knoke and Burke (1980) and Reynolds (1977). It is necessary, however, to explain some of the terminology and symbolism of the hierarchical log-linear technique in order to understand its use in the research presented here.

Hierarchical log-linear models can be used to explore the mutual association of varibles in contingency table data. The model generates expected cell frequencies for the contingency table, based on "effect" parameters, which are tested against the actual cell frequencies for goodness-of-fit. These effect parameters are estimated based on functions of ratios of actual cell frequencies. Association between or among variables in the table is determined by the number and strength of the parameters necessary to provide a good fit. A <u>saturated</u> model used to fit data in an I X J table, where one variable is student-postsecondary-plan (P) and the other variable is aptitude (A), has the form:

$$F_{ij} = \eta \tau_i^P \tau_j^A \tau_{ij}^{PA} \qquad [1]$$

In this model, F_{ij} represents the expected cell frequency in the ij-th cell, η is a baseline cell frequency, τ_i^P is the plan row effect, τ_j^A is the aptitude column effect, and τ_{ij}^{PA} is the plan/aptitude interaction effect necessary to generate the cell frequency. This model is saturated because all possible effects are present. While this particular form of the model is multiplicative, by taking the logarithm of both sides of Equation 1 an additive log form is produced. It is this form of the model which produced the name log-linear. This log transformation of Equation 1 has the form

$$\log F_{ij} = \log \eta + \log \tau_i^P + \log \tau_j^A + \log \tau_{ij}^{PA}$$

and bears a striking resemblance to the regression model for two-way ANOVA.

Rather than write an equation such as 1 above to identify the model, the symbol {PA} is used. The hierarchical form of the log-linear model described here requires that if a higher order effect is included in the model, e.g., {PA}, then all lower order effects signified by variable labels in the braces, i.e., P and A, must also be included. If the PA parameter is included in the model of best fit, its presence indicates an association between the plan and aptitude variables in the model. If there is no association between P and A in the model, the τ^{PA} parameter takes on a value of 1. A best-fit model showing no interaction between P and A but showing non-rectangular marginal distributions for both P and A would be symbolized by {P}{A}. If the plan variable in this example had a rectangular, i.e., equiprobable, marginal distribution and there was no two-way association, the model of best fit would be signified by {A}. One more example will be used to demonstrate the use and interpretation of this symbolism. Assume a three-way crossclassification of plan by aptitude by survey year having {PA}{AS} as the model of

best fit. This would indicate there is association between plans and aptitude and association between aptitude and survey year. There is, however, no association between plans and survey year nor any three-way association indicated in the model necessary to fit the data. Lower order parameters for plan, aptitude, and survey are required to be included, however, because of the hierarchical nature of the model.

The goodness-of-fit of a model is determined by the probability of a maximum likelihood chi-square (L^2) calculated from the expected cell frequencies generated by the model and the actual cell frequencies. Knoke and Burke indicate that this method works well for most social science surveys where the sample size is less than 1,500. "However, at times analysts will be interested in studying much larger data sets, such as census reports on the entire national population. The problem in judging best-fitting models is that L^2 is proportional to N. Hence, with potential sample sizes in the hundreds of thousands or millions, virtually the only model that will fit the data is the saturated model, even when some of the higher order interactions are very small.

To overcome this problem for large samples, analysts may approach model selection with an analog to the coefficient of determination (R^2) for multiple regression. A 'baseline' model is selected whose L^2 will serve as a standard against which to judge the improvement in fit obtained by trying more complex alternative models. The baseline L^2 indicates the amount of variability in the data not due to factors already in the model. When the proportion of the baseline L^2 accounted for by the alternative model is high (say 90 percent or more), the alternative may be judged to provide a satisfactory fit to the data even though strict statistical tests indicate a significant departure from expected frequencies under the alternative model. The R^2 analog is

$\{(L^2$ baseline model) - (L^2 alternative model)$\}/(L^2$ baseline model)" [2]

(Knoke and Burke, pp. 40-41). This technique was the one used in these analyses, since the data from the two surveys represented population estimates. The baseline model selected was the no interaction model for plans by aptitude by survey crossclassification, {A}{P}{S}.

Best Fit Models for Planning Data

Three sets of data were examined using the log-linear model. The first set consisted of all students in each of the base-year surveys of the NLS and HSB responding to the postsecondary planning questions. Only those responding to the categories 1) vocational school (VOC), 2) community college-vocational (CC-VOC), 3) community college-academic (CC-ACAD), or 4) four-year college or university (FOUR-YR) were analyzed. Subsequent analyses were conducted using only black and only white subsets of the first group.

The regression analog suggested by Knoke and Burke was used to identify the model of best fit for each of the groups analyzed. The baseline model against which the reduction in L^2 (see Equation 2) was measured was the mutually independent model, {A}{P}{S}, where A, P, and S represent the aptitude, planning, and survey-year variables. Table 1 shows the results of these analyses.

Three criteria were used to select the model of best fit for the three analyses. First, as suggested by Knoke and Burke, no model should be selected that explains less than 90 percent of the baseline model's L^2. Second, using the rule of parsimony, a more simple model is preferred over one more complex. The third criterion is that no higher order model will be rejected if it shows an appreciable increase in explained L^2 over the next lower order model selected using the first two criteria.

Table 1. Measures of Log-Linear Model Best-Fit Based on Maximum Likelihood Chi-Square (L^2) for Black, White, and All High School Senior Data Crosstabulations by Level of Postsecondary Institution Planned (P), Aptitude (A), and Survey Year (S).

			BLACKS		WHITES		ALL STUDENTS	
No.	Model	Degrees of Freedom	L^2	% of Base L^2 Explained	L^2	% of Base L^2 Explained	L^2	% of Base L^2 Explained
1	{A}{P}{S}	17	31388.6	Base	400528.9	Base	431771.2	Base
2	{AP}	12	10229.9	67.4	45558.9	88.6	48023.7	88.9
3	{AP}{S}	11	7117.4	77.3	27194.2	93.2	33849.3	92.2
4	{AP}{PS}	8	2249.6	92.8	2124.3	99.5	2496.8	99.4
5	{AP}{PS}{AS}	6	729.8	97.7	1709.2	99.6	1338.4	99.7

As is shown in Table 1, Models 3, 4, and 5 meet the first criteria above for the White and the All Students groups, while only Models 4 and 5 meet this criterion for the Black Student group. It is not surprising that the models for Whites and All Students are so closely parallel in percentage of L^2 explained, as whites predominate in the population. Model 5 was rejected for these two groups as the added complexity of the model (the second criteria) and loss of degrees of freedom was not compensated by an appreciable increase in explained L^2 (the third criteria). However, Model 4 for both of these groups does show an appreciable increase in L^2 explained over Model 3, 7.2 percentage points for All Students and 6.3 points for the White Student group, with very little added complexity in the model. Thus Model 4 was selected as the model of best fit for both of these groups. Selecting the best-fit model for Blacks was somewhat more problematic. Model 5 was selected for this group as the almost 5 percentage point increase in explained L^2 was deemed sufficient to offset the added complexity when compared to Model 4. This choice also brought the percentage L^2 explained for this group in line with that of the models selected for the other two groups.

Discussion of the Findings

The model of best fit selected for each of the groups have several commonalities. Each contains an aptitude by plan, (AP), interaction parameter and a plan by survey, (PS), interaction parameter. Additionally, the model for the Black group has an aptitude by survey, (AS), interaction parameter. Each of these interaction terms will be examined, in order, in the following discussion.

That an association between aptitude and plans must be accommodated to fit a model to the data is neither a particularly startling nor new conclusion.

Conventional wisdom and previous research (see Dunteman and Bailey) both support this finding. Larger percentages of more-able students plan to attend four-year institutions than is the case with the less-able students. A similar statement, although opposite in direction, can be made regarding vocational-school plans. Table 2 shows this relationship for the Black and the White groups. Since these results replicate earlier findings, they will not be discussed further. It is interesting to note, however, the absence of third order interactions among plan, aptitude, and survey variables. This would seem to indicate that the relationship between plans and aptitude did not change appreciably from 1972 to 1980.

The association indicated by the presence of the {PS} parameter in each of the models was more interesting. A significant change in the level of postsecondary institutions planned had occurred over the period 1972-1980 (see Table 3). A greater percentage of planners were choosing four-year schools in 1980 than did so in 1972, and smaller percentages were planning vocational schools in 1980 than in 1972. The percentage point increases in four-year planners in the White (7.2 points) and All Student (7.7) groups are larger in absolute magnitude than the corresponding decreases in vocational planners in these groups, 4.0 and 4.5 points, respectively. Thus the increase in four-year planners in these groups had come at the expense of both vocational schools and community colleges. The percentage point increases in those planning community college vocational programs would seem to support an upward "creep" argument for these groups, i.e., students formerly planning to attend vocational schools are now planning vocational or academic programs at community colleges, and those formerly planning to attend community colleges are now planning four-year matriculation. The Black group shows a similar but more pronounced change in four-year and vocational planners. The 9.5 percentage

Table 2. Weighted Numbers* of Black and White High-School Seniors Crosstabulated by Level of Postsecondary Institutions Planned and Aptitude (hundreds rounded).

LEVEL PLANNED	APTITUDE											
	BLACKS						WHITES					
	Low	% of Total	Middle	% of Total	High	% of Total	Low	% of Total	Middle	% of Total	High	% of Total
FOUR-YR	722	52.1	943	74.6	181	91.0	745	29.5	7208	52.0	8582	80.1
CC-ACAD	160	11.5	105	8.3	6	3.0	509	20.1	2968	21.4	1261	11.8
CC-VOC	167	12.0	97	7.7	4	2.0	469	18.6	1543	11.1	473	4.4
VOC	338	24.4	119	9.4	8	4.0	805	31.8	2143	15.5	402	3.7
TOTAL	1387	100.0	1254	100.0	199	100.0	2528	100.0	13862	100.0	10718	100.0

*Both the NLS and HSB oversampled minority and disadvantaged students. A weighting scheme is available in both surveys to compensate for this oversampling. The sum of the student weights equals the total population of high-school seniors in the spring of each of the survey years. These weights were used to generate the frequencies in this table.

Sources: Base Year Survey of the National Longitudinal Study of the High School Class of 1972 and High School and Beyond (1980).

Table 3. Weighted Numbers* of Black, White, and All High-School Seniors Crosstabulated by Level of Postsecondary Institutions Planned and Survey Year (hundreds rounded).

LEVEL PLANNED	BLACKS				WHITES				ALL STUDENTS			
	1972	% of Total	1980	% of Total	1972	% of Total	1980	% of Total	1972	% of Total	1980	% of Total
FOUR-YR	762	59.8	1084	68.8	8458	57.7	8077	64.9	9775	57.2	9716	64.9
CC-ACAD	126	9.9	145	9.2	2879	19.6	1859	14.9	3246	19.0	2171	14.5
CC-VOC	112	8.8	156	9.9	1246	8.5	1239	10.0	1520	8.9	1513	10.1
VOC	275	21.6	190	12.1	2087	14.2	1263	10.2	2557	15.0	1567	10.5
TOTAL	1275	100.1	1575	100.0	14670	100.0	12438	100.0	17098	100.1	14967	100.0

*Both the NLS and HSB oversampled minority and disadvantaged students. A weighting scheme is available in both surveys to compensate for this oversampling. The sum of the student weights equals the total population of high-school seniors in the spring of each of the survey years. These weights were used to generate the frequencies in this table.

Sources: Base Year Survey of the National Longitudinal Study of the High School Class of 1972 and High School and Beyond (1980).

point drop in vocational planners is slightly greater than the 9.0 point increase in four-year planners. Thus, for this group, the community college planners had increased slightly; a pattern dissimilar to that of the White group.

The most interesting and encouraging finding in this study was the inclusion of the aptitude by survey-year, {AS}, parameter in the model of best fit for the Black group. Table 4 shows the crosstabulation of these data. An examination of the table shows that the percentage of Blacks in the top quartile of the aptitude distribution has increased from 4.9 percent to 8.6 percent, a 3.7 percentage point gain over the period 1972-1980. A similar comparison for the middle two aptitude quartiles shows a 4.7 point gain, while the lowest quartile shows an 8.3 point decrease. The conclusion that can tentatively be drawn from this evidence is that, relative to the 1972 and 1980 high school senior populations from which the samples were drawn, Blacks seem to have increased in academic aptitude over the period 1972-1980.

Table 4. Weighted Numbers of Black High School Seniors Crosstabulated by Aptitude and Survey Year.*

APTITUDE	SURVEY YEAR			
	1972	% of Total	1980	% of Total
HIGH	6267	4.9	13523	8.6
MIDDLE	53334	41.8	73084	46.5
LOW	67986	53.3	70731	45.0
TOTAL	127587	100.0	157338	100.0

$\alpha_1 = 2.07$

$\alpha_2 = 1.32$

*Percentage totals may differ from 100.0 due to rounding.

In order to assess the strength of the association indicated by the inclusion of the (AS) parameter in the model, odds ratios (α_1 and α_2) were calculated from the cell frequencies in the table. Odds ratios have several important properties. The most important for the results reported here is that the odds ratios are insensitive to marginal distribution, i.e., proportional increases in cell size have little effect on the odds ratio. Odds ratios for any table showing the same percentage distribution as Table 4 will generate essentially the same numerical values (Reynolds 1977).

An odds ratio value of 1.0 indicates statistical independence. "Values less than 1.0 imply a 'negative' association, while values greater than 1.0 mean a positive relationship" (Reynolds 1977, p. 22). Since the odds for the 1980 cells were in the numerator of the ratio and those for 1972 in the denominator, the values of the two alphas support the conclusion above. However, the magnitude of the ratios indicates that the relationship is moderate at best. The α_1 ratio was calculated using the high and low cell frequencies, while α_2 was calculated on the middle and low cell frequencies.

Several caveats are in order to place the conclusion regarding changes in Black aptitude scores in proper perspective. Nonresponse rates differ between the two surveys. The effect of the higher non-response rate on the aptitude portion of HSB than was experienced by NLS may have some impact on the Black aptitude distribution. These effects have not been addressed by the survey contractor. Further, the decline in the ACT and SAT aptitude scores would indicate that there has been an overall decline in aptitude scores over this period. Thus, inferring from the conclusions above that there has been an absolute increase in the aptitude of Blacks would not be warranted. Peng (1981) lists several other considerations that must be taken into account when comparing the data from the NLS with those of HSB. The conclusion is an

interesting one, however, and certainly warrants further investigation.

Conclusions

If, as Frances (1980) suggests, enrollment declines can be ameliorated by dipping deeper into the college-age cohort, the data presented here would seem to indicate that such efforts might not produce the desired results. Certainly high-school seniors planning some postsecondary education should be prime candidates for enrollment in traditional community college or baccalaureate programs. An examination of Table 3 shows, however, that 90 percent of the 1980 group were already planning to attend community colleges or four-year schools. Further, the traditional schools seem to have already siphoned off a sizeable percentage of the students planning to attend vocational schools. Vocational schools, being predominately proprietary, usually have quite effective marketing programs and offer incentives, e.g., job placement, short, no frills programs, that traditional schools are hard pressed to match. Thus, this source of students may have already been reduced as much as possible by community colleges offering vocational programs, as indicated by the modest increases in students planning vocational programs at community colleges over the period.

The data in Table 2 do show that there is a sizeable pool of low-aptitude students planning to attend colleges and universities. Over 75 percent of the Blacks and over 68 percent of the White students in this aptitude quartile are planning to attend such schools. Since the rates of realization of plans for students in this aptitude quartile are quite low (see Brown 1980; Dunteman and Bailey 1975), a vigorous marketing effort might be able to convince more of these students to attend than do so currently. The cost of such an effort and the coordination required of the postsecondary community to mount such an

effort would seem to dictate against its success.

Several conclusions regarding trends in the quality of students planning to attend postsecondary institutions must be noted. The finding of no three-way association among the variables level planned, aptitude, and survey year, Blacks excepted, indicates there has been no change in the relative aptitude of students planning the various institutional levels over the period 1972-1980. This being the case, the decline in the scores of the well-known standard college aptitude tests would indicate that the quality of students in 1980 was not as high as it had been in 1972. The increase in the relative aptitude of Blacks found in this study seems to indicate that quality of this subpopulation had increased slightly over the period. Whether this increase compensates for some of the decline in standard college aptitude scores is an unanswered question at this time.

Of more importance than the change in the quality of students planning postsecondary education is the change in quality of the students actually attending postsecondary institutions. Data with which to analyze this aspect of the problem over the period 1972-1981 will be available when the first follow-up survey of HSB is released.

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